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PROCESSING AND QUALITY STUDIES OF SHRIMP HELD IN REFRIGERATED SEA WATER AND ICE

Part 5 - Interchange of Components in a Shrimp-Ice System

By Jeff Collins*

ABSTRACT

Pink shrimp were held for various periods in ice. Data are given showing the effect of holding time on the weight of the peeled meats and precooked meats. Changes in water, ash, salt, and solids contents of the meats are also given.

BACKGROUND

In the previous paper in this series, the material balance of a system of shrimp and refrigerated sea water was reported (Collins 1960). Changes in water, salt, ash, and solids contents of the components of the system were observed to be a function of the holding time. Significantly, it was found that as a function of holding time, both the raw meats and the precooked meats lost considerable solids.

The purpose of the experiment reported here was to determine if pink shrimp held in ice undergo similar changes.

EXPERIMENTAL

The general experimental approach was to hold whole pink shrimp in ice under ideal conditions and then, as a function of holding time, to determine any changes in weight in the moisture, salt, ash, and solids contents of the raw and precooked meats.

MATERIAL: Whole, fresh, pink shrimp (Pandalus sp.) were iced overnight in Petersburg, Alaska. Upon being received at the Ketchikan Laboratory on the following morning, they were briefly rinsed in cold fresh water and were allowed to drain for 15 minutes in a wire basket.

HOLDING METHOD: The drained shrimp (1,350 grams for each of five samples) were placed on a single layer of cheese cloth and were mixed with four times their weight of ice. The cloth was folded over the mixture of ice and shrimp and was placed on top of a layer of ice 1-foot deep in an insulated ice chest. The samples were covered with 6 inches of ice and were top-iced every other day.

SAMPLING TECHNIQUE: 1. At various intervals during a total holding period of 9 days samples were removed from the ice chest (fig. 1), and the shrimp were separated from the ice by hand and were allowed to drain on a wire screen for 5 minutes.

*Chemist, Technological Laboratory, Division of Industrial Research, U. S. Bureau of Commercial Fisheries, Ketchikan, Alaska.

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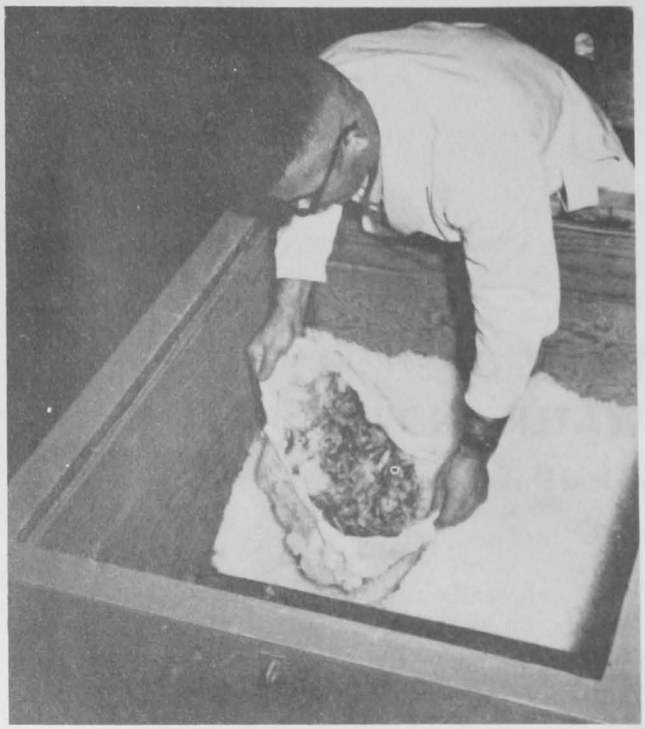

Fig. 1 - Removing a sample of shrimp stored in ice for analysis.

2. The whole shrimp were carefully peeled by hand so that all meats were separated from the waste.

3. The meats were weighed, and a portion was saved for subsequent analysis.

4. The remaining meats were reweighed and precooked as described in the previous paper (Collins 1960); that is, they were cooked exactly 2 minutes under a slightly positive steam pressure, followed by cooling for 5 minutes on a cloth towel. The samples were then reweighed and saved for subsequent analysis.

ANALYTICAL METHODS: The analyses for moisture, total chloride, and ash were carried out as previously described (Collins, Seagran, and Iverson 1960).

RESULTS AND DISCUSSION

The weights of the peeled and precooked meats and their contents of water, ash, salt, and solids for each period of holding are given in tables 1 and 2. The data for the raw and precooked meats have been adjusted so that each value is independent of the removal of prior samples. The values given for ash are termed "corrected ash" and were obtained by subtracting the salt from the total ash. The solids values do not include ash or salt. The solids therefore consist essentially of the nitrogeneous components of shrimp along with a small amount of oil and other minor constituents.

GROSS WEIGHT CHANGES: Data from tables 1 and 2 indicated that there is an over-all gain in weight in both the whole shrimp and the peeled meats. Since this gain is caused, for the most part, by uptake of water that is later lost during the precook, it was thought that any consideration of yield would be quite meaningless if based on these two components of the system. Consequently, the solids data of the precooked meats were used as a base for yield.

PEELED MEATS: The raw meats gained in weight rapidly, owing to the absorption of water. This over-all increase in weight was accompanied by a loss of salt and solids. Corrected ash values were unchanged.

Table 1 - Raw Peeled Meats: Change in the Weight of the Raw Peeled Meats and of Their Component Parts With Time of Holding in Ice

Holding Time	Total Weight of Peeled Meats After Various Holding Periods of Time	Total Weight of the Components of Peeled Meats After Holding 1,350 g. Whole Shrimp in Ice for Various Time Periods			
		Water	Chloride	Corrected Ash (ash-NaCl)	Solids1/
Days	Grams	Grams	As g. NaCl	Grams	Grams
0	444	365	3.6	2.7	73
1	499	417	3.5	2.7	76
3	495	423	2.5	3.9	66
5	508	439	1.8	2.7	64
7	499	432	1.8	2.8	62
9	501	440	1.1	2.6	58

1/Solids: The total weight of solids, other than ash and NaCl. This solids value is essentially the nitrogeneous components plus certain minor constituents. The solids value is obtained by subtracting the water, NaCl, and corrected ash from the total weight for each holding period.

PRECOOKED MEATS: The water content of the precooked meats increased during the first day of holding and then slowly decreased. Longer holding periods resulted in lower salt, ash, and solids contents.

Table 2 - Precooked Meats: Change in Weight of the Precooked Meats and of Their Component Parts With Time of Holding in Ice

Holding Time	Total Weight of Precooked Meats After Various Holding Periods of Time	Total Weight of the Components of Precooked Meats After Holding 1,350 g. Whole Shrimp in Ice for Various Periods of Time			
		Water	Chloride	Corrected ash (ash-NaCl)	Solids
Days	Grams	Grams	As g. NaCl	Grams	Grams
0	273	207	2.2	2.7	61
1	305	237	2.0	2.9	63
3	280	221	1.9	2.4	55
5	274	217	1.2	2.2	54
7	267	211	1.0	2.4	52
9	253	202	0.6	2.3	49

1/See footnote table 1.

ICE VERSUS BRINE HOLDING: Since the shrimp used in the experiment reported here were caught 5 months later than those used in the previous experiment on brine holding (Collins 1960), direct comparisons cannot be made between the two lots of shrimp held in ice and brine. However, the general trend for the two systems can be compared. Even though solids were lost in solution, holding whole shrimp in either ice or refrigerated sea water resulted in a substantial increase in gross weight, primarily caused by an uptake of water. The raw peeled meats subsequently obtained from shrimp held in either ice or refrigerated sea water also gained in gross weight because of water uptake and despite the lost solids. The precooked meats from these two systems of holding went through similar changes except that the water content increased only slightly the first several days of holding, then gradually decreased.

Thus, the processor of canned shrimp will suffer a significant loss in yield as a function of holding time by use of either system. At present, it seems that the best way to minimize loss of yield is to process the shrimp as quickly as possible after they are captured.

SUMMARY

It was reported in the previous paper in this series that definite changes occur in the water, salt, ash, and solids contents of the various components of a system of shrimp and refrigerated sea water. The purpose of the work reported here was to determine if similar changes occur in shrimp held in ice. Accordingly, whole, raw, pink shrimp were held in ice up to 9 days. The raw meats and subsequently prepared precooked meats were analyzed for water, ash, salt, and solids contents; and the general trends were compared with those obtained in the experiment employing refrigerated sea water. As a consequence of holding in ice, both the whole shrimp and the raw peeled meats gained in weight and lost solids and salt. Except for the first day, when the water content increased, the water, ash, salt, and solids contents of the precooked meats all decreased with holding time.

A comparison in the general trend of the data between the two systems of holding indicate that there is a considerable loss in yield as a function of time of holding in either system.

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